DRAFT

PERFORMANCE WORK STATEMENT (PWS)
Flight Inspection Scheduling Optimization
Modeling System Requirements

1.0 GENERAL

1.1 Requiring Office: Federal Aviation Administration (FAA), Aviation System Standards (AJW-3), Flight Inspection Operations Group, Flight Inspection Central Operations (FICO) Team, AJW-3XX.

1.1.1 Task Name: Flight Inspection Scheduling Optimization

1.1.2 Performance Time: 1 year development and integration (See deliverables Section XX)

1.1.3 The Contracting Officer (CO) may delegate, in writing, specific Contracting Officer's Technical Representative (COTR) personnel to interact with the FAA and contractor engineers during the duration of this contract. These personnel possess no implied or express authority to change the contract, the TPWS, or otherwise commit the Government. The Contracting Officer Representative (COR)/COTR are not authorized to make changes that affect cost, schedule, delivery, or scope of work.

1.2 **Scope of Work:** Aviation System Standards, (AJW-3) Flight Inspection Operations Group (AJW-33) is currently investigating the use of optimization software modeling methods that may provide schedules for more efficient flight inspection trips (itineraries) while also meeting several defined operational objectives dealing with National Airspace Systems (NAS) availability. The purpose of this Performance Work Statement is to provide the high level requirements for a model system to be built on mathematical programming optimization techniques that would meet these objectives.

2.0 FAA Flight inspection system Configuration

There are three major categories of flight inspections:

2.0.1 Periodic Inspections. Periodic inspections are required for Navigational Aids and Instrument Flight Procedures. Types of periodic inspections, requirements and extension policy are detailed in FAA Order 8200.1 and TI 8200.52. Periodic Inspections constitute about 34% of all flight inspection operations. These are the most predictable of the flight inspection types and can be scheduled well in advance of their due date. Periodic inspection requirements are automatically generated within FOMS.

2.0.2 New/Amended Procedures Inspections. New and amended flight procedures must be evaluated for flight inspection requirements prior to publication. If a flight inspection is required, it must be done prior to the publication cut-off date. Approximately 26% of all flight inspection operations are from new or amended procedure inspections. For the most part these are also fairly stable and known well in advance of the publication cut-off date. New/amended procedures requirements are entered manually into FOMS via a Web-interface. It should be noted that the number of

procedures sent to flight inspection is expected to increase at about 15-20% a year for the next 4 years. Furthermore, even if flight plan goals are reduced, AJW-3 will be increasing its maintenance activities on projects that have previously been deferred. The increased procedure production capacity will be the result of integration and the deployment and maturing of new tools and databases. The majority of this growth will be for Performance Based Navigation procedures. As planning function shifts , it will be important to continue efforts towards geographic and seasonal consideration in scheduling procedure projects to maximize scheduling productivity.

2.0.3. Special Request Inspections. "Specials" can occur from a variety of reasons, many of which are related to emergencies and unplanned events, new installations or equipment upgrades. Approximately 40% of flight inspection operations fall into the "Specials" category. Some of these can be scheduled in advance (e.g., upgrades of equipment) while others cannot (e.g., emergency fixing of equipment). "Special" requests are entered into FOMS manually via a Web-interface. They are also called in to the appropriate Operational Control Centers (OCC) where an event management work order ticket is entered by TECHOPS personnel into the Remote Monitoring and Logging System (RMLS)[1]. It should be noted that there is currently no automatic interface between FOMS and RMLS to keep the status of work orders in both systems synchronized. Special request will also typically require NOTAMS to be issued which currently is also communicated manually to TECHOPS. Inspection requests are also generated to commission new Navigational Aids. These inspection requirements are the most complex inspections as all parameters of the equipment are established.

2.1 Crews to perform inspections are typically comprised of two Flight Inspectors (pilots) and one Mission Specialist. Occasionally, a second mission specialist is required. Pilots need to be certified on the specific aircraft they are flying; not all pilots are certified on all aircraft. Likewise, the mission specialists need to be certified on the types of inspections they perform; not all mission specialists are certified on all types of flight inspections. Furthermore, specific aircraft are equipped to handle various types of inspection; not all aircraft are equipped to handle all types of inspections. The current inventory of aircraft includes 18 Beechcraft 300's, 6 Lear 60's, and 4 Challengers; two other aircraft are on order. To facilitate the matching of available aircraft with available crews, spreadsheets of Long Range Crew Availability and Long Range Aircraft Availability are maintained.

For flight inspection purposes, organizationally the NAS is broken up geographically into three Service Areas (West, Central, East), each having two Flight Inspection Field Offices (FIFOs) for a total of six FIFOs. Both specific aircraft types and crews are aligned to a specific service area. When short term demand exceeds capacity in a specific region, or should an efficient scheduling opportunity exist, assets (aircraft and crew) from one region may be "loaned" to another region. As a specific aircraft is taken out of operation from a region for periodic maintenance or upgrade, a similar type aircraft is returned to the region so as to keep intact the region's capacity to fly its operations.

A typical trip (itinerary) for a flight crew is four to five days in length and consists of several flight inspection operations. Some of these operations may have a "hard" due date/ time requirement while others may have "soft" due-dates/times[2]. 80-90% of domestic operations consist of normal Monday to Friday 5.5 flight hour duty days, 10% are night inspections and 5% occur on weekends. 20-25% of the operations also require some maintenance on the ground (monitor checks) in which case the appropriate Operational

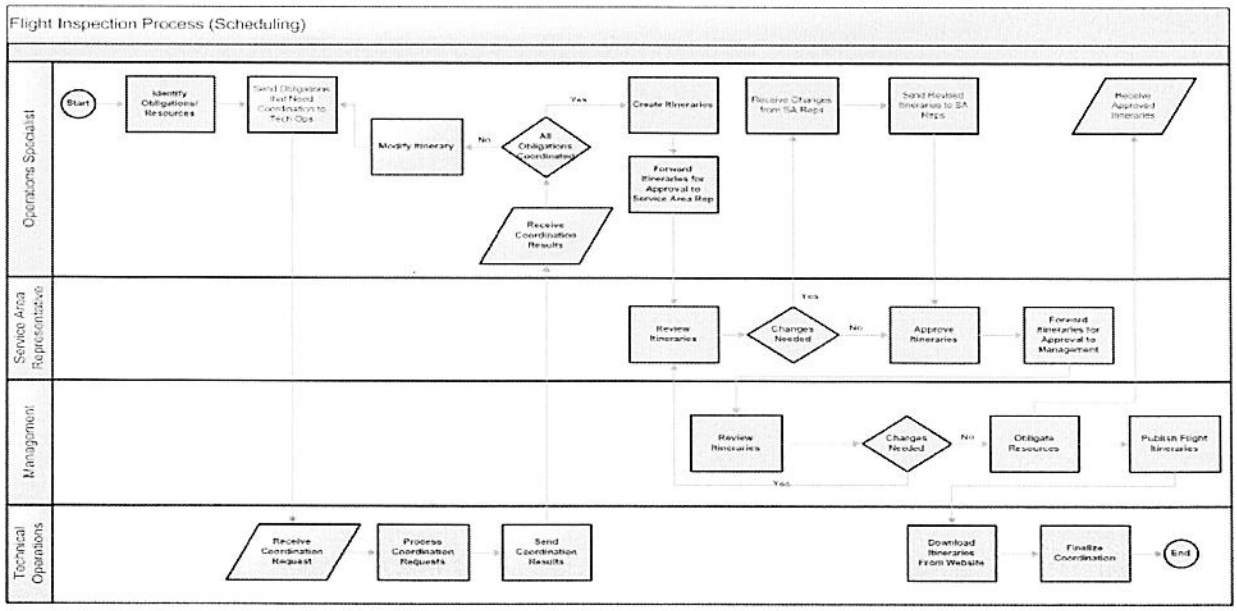
Control Command needs to be notified and coordination between the flight inspection crews and the on-ground TECHOPS mission specialists needs to occur[3]. It should be noted that Air Traffic has the ultimate say over whether a planned flight inspection operation can be executed. Given an airport's air traffic demand and other considerations at a date and time, Air Traffic can deny an operation from occurring when planned. For this reason and others (e.g., weather), flight inspection crews carry "alternative schedules" in the event that some unforeseen event prevents the crews from executing their primary schedule.

Other operational parameters that must be considered included:

(a) Contract Fuel Pricing. Not all airports have a contract fueling arrangement with the FAA. For those airports not having this arrangement, fuel needs to be bought at market price. So either the model needs to ensure that a contract-price airport is selected for lunchtime and overnight refueling or the difference between non-contract fuel cost and contract fuel cost is estimated for the various airports and let the model decide whether it's cost effective to chose a contract fueling station or not. Currently, the modus operandi is for flight crews to lean toward lunching and overnighting at a contract fuel airport if possible.

(b) Overnight Hangar Availability. Having an overnight facility that can hangar the aircraft during a trip is apparently important, especially in the winter in the Northeast locations. Without "hangaring" the aircraft in winter, the aircraft may need to de-iced (with some cost) as well as there is the crew time expended to perform the de-icing and to warm the aircraft. Hangar availability is also desirable anytime there was precipitation (not just winter) so the model should include an option to switch this requirement on/off depending upon the forecast.

(c) While many of the flight inspection trips are executed as planned, there are a host of variables that can affect the final executed itinerary. These include unexpected weather, air traffic, Tech Ops Support, ATC at a facility, unexpected aircraft maintenance, etc. When these occur typically the flight crew calls into the FICO scheduler to receive update instructions, especially if the alternative plan is also not feasible. Depending on whether the problem occurs early or late within a weekly itinerary, the FICO scheduler may wish to re-optimize the weekly schedule from the point the problem occurred. Therefore the model should have the ability to re-optimize an itinerary from *any* origin point to a specified destination point.



2.2 The major functional requirements of the flight inspection schedule optimization modeling system must address are as follows:

(a) Optimize Along Multiple Criteria (Objectives). Essentially there are two main categories of criteria that the model needs to optimize. The first category relates to meeting operational objectives including servicing the NAS, meeting flight plan goals and meeting publication schedule goals. The second category is financial in nature and includes maximizing the "On Scene" to "Enroute" time ratio and not exceeding budget constraints for overtime, TDY, and fuel.

(b) Consider Current Realism Scheduling Constraints. This will include such things as time restrictions at airports, anticipated time to perform flight inspection work tasks, expected enroute times between facilities, expected weather impacts, and unplanned inspections.

(c) Decision Support. The model will be developed to help the current flight inspection scheduling staff determine operationally - effective, cost-efficient schedules. It is still expected that human judgment will need to exercise in the scheduling process even if it's merely validating the model's suggested itinerary in some cases.

(d) What If Capability. The modeling system should allow the scheduler to override various modeling parameters to determine the impact on a flight itinerary. For example, the scheduler may wish to increase the crew availability time to determine the impact on the itinerary. Similarly, the scheduler may wish to increase or decrease the geographical coverage to determine the impact on the itinerary. Similarly the scheduler may wish to re-prioritize inspections at a certain facilities in a geographic area to determine the impact on the itinerary.

(e) Cost versus Optimize. The modeling system should be able to cost any proposed itinerary that is input. This implies that a costing algorithm will need to be defined based on cost of aircraft operations to the 10^{th} of a flight hour.

(f) Optimizing Logic. The model will be developed around the following logic for developing weekly flight inspection itineraries:

1. Within a designated geographic area defined by the Shift Box Query function in FOMS, first determine a schedule that will meet any "hard" scheduling requirements.
2. Then optimize around the "hard*" requirements based on the priorities of the "soft**" requirements found within a specified distance of the designated geographic area.
3. Prepare the circuit from an aircraft's "home base" to "home base" incorporating the logic of (a) and (b) above.

(g) Operations Requirements. The three operations requirements discussed above concerning contract fueling, hangar availability and problem recovery need to be included in the model. Other operations requirements may also need to be incorporated as identified from field offices other than those identified for the Atlantic City field office.

* Hard requirements -- are where a specific time of inspection is given

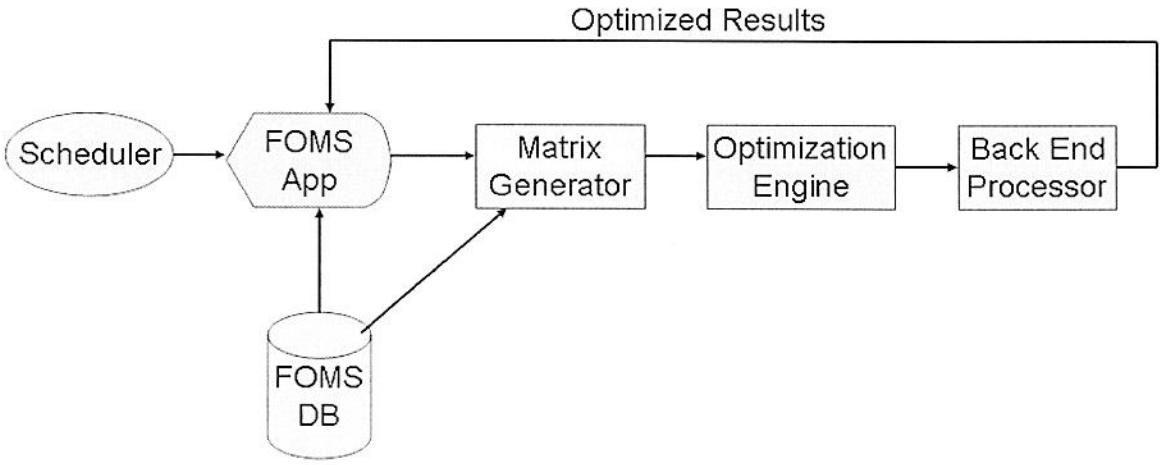
** Soft requirement -- are where an inspection can be accomplished any time within a general time frame.

3.0 System performance and primary task:

The contractor shall provide Optimization Modeling software for crew scheduling application incorporating methods that provide schedules for more efficient flight inspections trips (itineraries) while also meeting several defined operational objectives dealing with NAS availability.

3.1.1 Functionality Requirements

3.1.1.1 Integration with FOMS[4]. The model needs to be seamlessly integrated with the existing FOMS system rather than reside as a separate system. A schematic of how this may work is shown below.



3.1.1.2 As with any new or major modification of a system, there are always non-technical requirements that also need to be investigated in the way of procedures, policies, personnel training, possibly realignment of some responsibilities, system support, among others. These additional requirements will need to be fully flushed out during the Detailed Design and Development phases of the project.

3.2 Schedule of Phases to Accomplish requirement

(1) **Phase 1** -- The contractor shall do a capability assessment study of the current FAA Flight Operations Management System (FOMS) as Phase 1. Contractor shall provide Implementation Plan to FAA for review and concurrence.
(See CDRL A001)

(2) **Phase 2** -- Under Phase 2, contractor shall Conduct functional gap analysis of their commercial off-the-shelf software programming for Scheduling Optimization Modeling software and provide a written presentation that identifies where requirements are met and what gaps are left and what they will do to incorporate methods that provide schedules for more efficient flight inspections trips (itineraries) while also demonstrate how they will be meeting the defined operational objectives dealing with

NAS availability. The contractor shall evaluate their software using the seven (7) major functional requirements as stated in Paragraph 1.2.1 above, and provide to the FAA a subjective evaluation of the pros and cons and cost of meeting the requirement and also of the Gaps that will need to be fixed in their commercial Optimization Modeling software package to make it acceptable to the FAA. Presentation will include estimated implementation/integration cost, capability improvement provided by new software, weakness and strengths of each, implementation/integration milestones of each, cost of software license, and cost of maintenance for 5-years.

Vendor will do the following under this Phase:

a. Conduct functional gap analysis of their software
b. Price out cost to customize for gaps and cost of their software
c. Define technical requirements to interface to FOMS and price out these development cost necessary to meet FAA requirements
d. Provide presentation to FAA as stated above.

(3) **Phase 3** – Contractor Implementation and integration of Flight Inspection Scheduling Optimization Software/commercial license. Under Phase 3 the contractor shall implement and integrate the Flight Inspection Scheduling Optimization software selected by the FAA. Contractor is responsible for the implementation interface with the general architecture of the current flight inspection scheduling process. The current system is a Java/Oracle-based system named Flight Operations Management System (FOMS). FOMS's primary functionality is to facilitate the development and management of the flight inspection itineraries. With information provided by FOMS, as well as from data provided on the Long Term Aircrew Schedule and Long Term Aircraft Schedule spreadsheets, flight inspection schedulers in FICO build within FOMS the proposed itineraries for flight inspection trips (tours) using their own heuristic procedures and rules. These itineraries are reviewed by the appropriate TECHOPS group and airport Air Traffic personnel for possible conflicts (e.g., runway demand) and resource requirements (e.g., on-ground personnel). Contractor shall also provide recommendations for future enhancements to AJW-3's crew scheduling system.

Vendor will do the following under this Phase:

a. Vendor shall provide a Transition plan for implementation and integration
b. Vendor shall develop training for FAA personnel

(4) **Phase 4-** Operational test and evaluation of final configuration.
The contract shall run an operational test of the new Optimization tool against two weeks of flight inspection itineraries generated in the manual method. Optimized itineraries shall be compared to manual generated itineraries to determine benefits of Optimization tool.

Vendor will do the following under this Phase:

a. Provide Operational test and evaluation Plan to FAA for approval
b. Provide a training class to FAA personnel
c. Provide techincal support for primary users via net-meeting for 6 months.

Phase 1- starting with contract award through 45 days ARO

Pase 2 – Start 46 days ARO –Complete 90 days ARO

Phase 3—Start 91 days aro – Complete 180 days ARO

Phase 4—Starting 181 days ARO – Complete 200 days ARO

4.0. **Personnel Qualifications**: Contractor personnel must have knowledge and skills in programming for Scheduling Optimization Modeling software, aircraft scheduling, implementation and integration of systems, testing and evaluatin of system capabilities and be able to provide the support required to meet the requirement as stated within this task.

5.0 **Work Location:** Contractor services for this task shall be performed primarily at the contractor's facility. Some services may require performance at the Mike Monroney Aeronautical Center (MMAC), Oklahoma City, Oklahoma.

6.0 **Travel**: Contractor personnel who are directed by the CO or the COTR, as delegated, to travel away from the contractor's facility shall do so pursuant to the contract.

7.0 **Invoice Procedures**: The contractor shall invoice for payments in accordance with (input contract information) of the contract.

8.0 **DEFINITION OF TERMS/ACRONYMS:**

Unless otherwise defined in this TPWS, all terms and conditions shall be defined in this TPWS.

ADS-B—Automatic Dependent Surveillance - Broadcast
AFIS—Automatic Flight Inspection System
AIRNAV—Aero Navigational Services database;
FACTS—Flight Activity Crew Scheduling System
FICO-- Flight Inspection Central Operations
FOMS -- Flight Operations Management System
IFP—Instrument Flight Procedures
LAAS—Local Area Augmentation System
NAS--National Airspace System
NOTAMS—Notice to Airmen
PTS—Procedures Tracking System
RMLS—Remote Monitoring and Logging System
RNP—Required Navigation Performance
TECHOPS—Technical Operations group
OCC-- the three regional Operations Control Centers
SOC-- Systems Operation Centers working at a major airport
WASS—Wide Area Augmentation System

9.0 GOVERNMENT FURNISHED PROPERTY AND SERVICES

The FAA plans on granting Virtual Private Network (VPN) with read and write access to a development environment. Read –only access will be provided for test and production environments. The FAA will host all environments.

10.0 CONTRACTOR FURNISHED PROPERTY AND SERVICES

10.1 The contractor shall provide qualified personnel, related equipment, supplies, and services necessary for the successful performance of this TPWS. The contractor shall bear the cost of training and certifying personnel supporting the requirements of this contract.

10.2 The contractor shall be responsible for obtaining copies of the applicable standards and specifications in Section 7.0.

11.0 REPORTS

The contactor shall provide monthly status reports, including an updated Master Program Schedule, to the FAA COTR, COR, and CO

12.0 REGULATIONS AND MANUALS

The following Guidance is provided for operational business rules:

T.I 4040.50 Flight Inspection Operations Manual
VN200 8200.8 Flight Inspection Central Operations SOP
Federal Aviation Regulations Part 135